

XMUT202 Digital Electronics

Tutorial 8: Liquid Crystal Display (LCD)

A. Liquid Crystal Display (LCD)

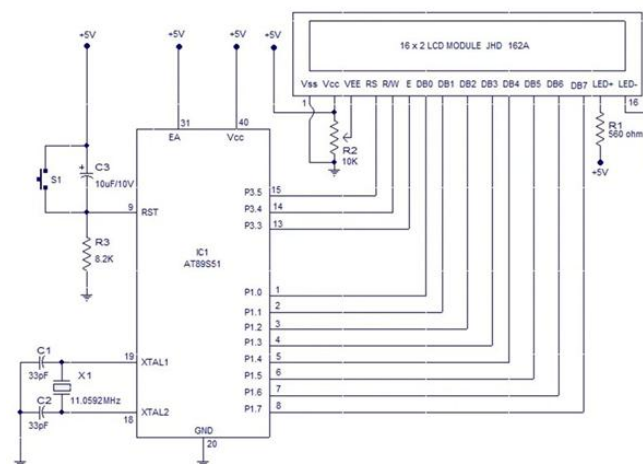
1. Describe common electronic circuit that provides interfacing between the 8051 microcontrollers with the LCD. [10 marks]
2. Write a generic pseudocode for initialising the LCD from the 8051 microcontrollers. [4 marks]
3. Write a generic pseudocode for sending data to the LCD from the 8051 microcontrollers. [5 marks]

B. LCD Programming

1. Write an assembly language program for 8051 microcontroller that will interface with the LCD as shown in the figure below. [32 marks]

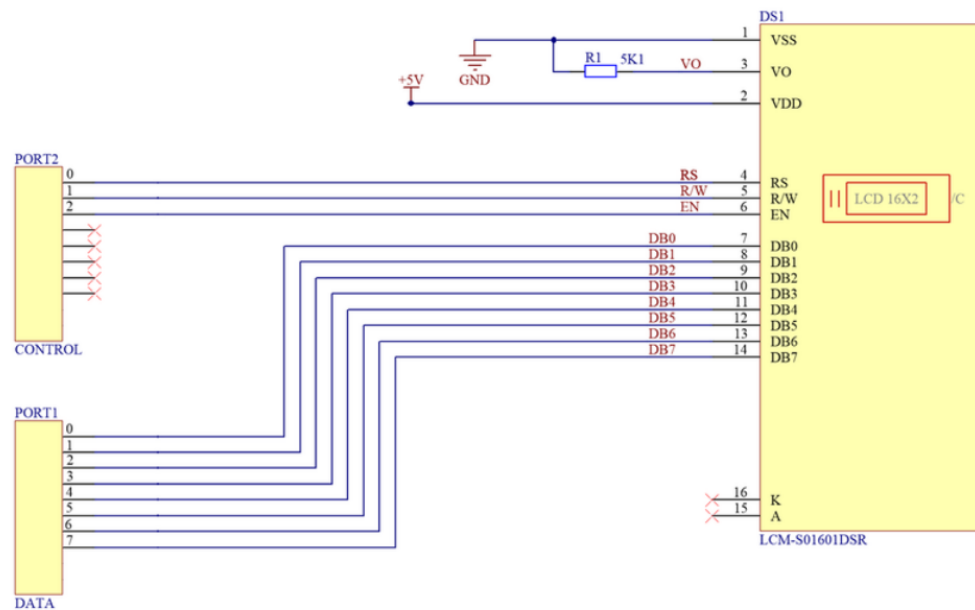
Design specification of the program is outlined as follows:

- LCD mode uses 2 lines and 5x7 matrix.
- When LCD is ON, the cursor ON and cursor blinking is also ON.
- Apply command, read, and write subroutines to help you better structure your program.
- Implement best practices in embedded system development with respect to the signal configuration, use of delay between instructions, etc.
- Write a character on the first line and another character on the second line for testing.



Appendix – LCD Instruction Sets

The circuit connection with the LCD from the 8051 microcontroller is as shown below.



Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Execution time
Clear display	0	0	0	0	0	0	0	0	0	1	Clear display.	1.52 ms
Cursor home	0	0	0	0	0	0	0	0	1	-	Cursor home.	1.52 ms
Entry mode set	0	0	0	0	0	0	0	1	I/D	SH	I/D: Shift cursor left/right. SH: Shift display right/left.	37 us
Display on/off control	0	0	0	0	0	0	1	D	C	B	D=1 Entire display on. C=1 Cursor on. B=1 Blinking cursor on.	37 us
Cursor/display shift	0	0	0	0	0	1	D/C	R/L	-	-	D/C: Shift cursor left/right. R/L: Shift display left/right.	37 us
Function set	0	0	0	1	1	DL	N	F	-	-	DL: Interface data is 8/4 bits. N: Number of lines is 2/1. F: Font size id 5x11/5x8.	37 us
Set cursor	0	0	1	X	X	X	X	X	X	X	Set cursor at the beginning of line 1	37 us
Read busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Read status.	0 s
Write data to address	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data.	37 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data.	37 us